Appl. No. 09/995,759
Amdt. Dated November 14, 2005
Reply to Office action of August 23, 2005
Attorney Docket No. P13578-US1
EUS/J/P/05-1305

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Cancelled)

2. (Currently Amended) A method in a wireless communication system comprising at least one transmitter provided with at least two antennas and at least one receiving unit provided with at least one antenna and wherein training sequences are transmitted from the at least two antennas of the at least one transmitter to the at least one antenna of the at least one receiving unit, characterized in that

first, prior to the transmission, a training sequence P(k) is Inverse Discrete Fourier Transformed to a sequence p(n);

second, for each antenna branch the Inverse Discrete Fourier Transformed sequence p(n) is cyclically rotated by a ~~number of~~ predetermined ~~steps~~ <u>step, said predetermined step</u> being different for each antenna branch to generate cyclically rotated training sequences p(n-n1), p(n-n2);

third, the cyclically rotated training sequences p(n-n1), p(n-n2) are transmitted concurrently from said at least two antennas to the receiving unit; and

fourth, at the receiving unit receiving the cyclically rotated training sequences, the received sequences being a superposition of transmitted training sequences, each individually affected by the propagation medium, are used to provide channel impulse response estimates for the transmission from respective antenna.

3. (Previously Presented) The method according to claim 2, characterized in that instead of an Inverse Discrete Fourier Transform, an Inverse Fast Fourier Transform is performed.

4. (Previously Presented) The method according to claim 2, characterized in that a cyclic extension having a predetermined length is added to each sequence prior the transmission, the cyclic extension being greater than a delay spread.

5. (Previously Presented) The method according to claim 2, characterized in that the distance between each step is greater than a delay spread.

6. (Previously Presented) The method according to claim 2, characterized in that at the receiving unit the received sequence

in a first step, is Discrete Fourier Transformed and divided by the training sequence P(k),

in a second step, the result from the first step is Inverse Discrete Fourier Transformed resulting in a sequence having distinctly separated regions in the time domain, the separated regions containing the respective channel impulse response estimates.

7. (Previously Presented) The method according to claim 3, characterized in that at the receiving unit the received sequence

in a first step, is Fast Fourier Transformed and divided by the training sequence P(k),

in a second step, the result from the first step is Inverse Fast Fourier Transformed resulting in a sequence having distinctly separated regions in the time domain, the separated regions containing the respective channel impulse response estimates.

8. (Previously Presented) The method according to claim 6, characterized in that

fixed predetermined ranges are selected in the discrete time domain;
each range comprising one and only one of the above defined regions; and
one channel impulse response is selected from each of said ranges.

9. (Cancelled)

10. (Previously Presented) The method according to claim 8, characterized in that each resulting channel impulse response is converted to the frequency domain by a DFT or FFT operation depending on operating methods of primarily equalizer and FEC decoder.

11. (Previously Presented) The method according to claim 6, characterized in that a window function is applied prior to the second step, wherein leakage inherent in the transformation in the first step is reduced.

12. (Previously Presented) The method according to claim 6, characterized in that a filter function is applied after the second step, wherein leakage inherent in the transformation in the first step is reduced.

13. (Currently Amended) The method according to claim 11, characterized in that said window function is a Hanning window ~~or said filter Inversion is an IDFT transformed Hanning window~~.

14. (Currently Amended) The method according to claim [[8]] 11, characterized in that an inverse impulse response corresponding to the window function is applied after the selection of said channel impulse response, wherein the phase and amplitude values are compensated due to the result from a preceding window.

15. (Currently Amended) The method according to claim [[8]] 11, characterized in that an inverse function is applied after the conversion to the frequency domain by a DFT or FFT operation, wherein ~~the~~ phase and amplitude values are compensated due to ~~the~~ a result from a preceding window.

16. (Currently Amended) A wireless communication system, comprising:

at least one transmitter provided with at least two antennas; and,

at least one receiving unit provided with at least two antennas; ~~and~~

wherein training sequences are transmitted from the at least two antennas of the at least one transmitter to the at least two antennas of the at least one ~~receiver~~ receiving unit~~, characterized in that~~; wherein:

first, prior to the transmission, a training sequence P(k) is Inverse Discrete Fourier Transformed to a sequence p(n);

second, for each antenna branch the Inverse Discrete Fourier Transformed sequence p(n) is cyclically rotated by a ~~number of~~ predetermined ~~steps~~ step (n1,n2), said predetermined step being different for each antenna branch to generate cyclically rotated training sequences p(n-n1), p(n-n2);

third, the cyclically rotated training sequences p(n-n1), p(n-n2) are transmitted concurrently from said at least two antennas to the receiving unit; and

fourth, at the receiving unit receiving the cyclically rotated training sequences, the received sequences being a superposition of cyclically rotated transmitted training sequences each individually affected by the propagation medium, are used to provide channel impulse response estimates for the transmission from respective antenna.

17. (Previously Presented) The system according to claim 16, characterized in that instead of an Inverse Discrete Fourier Transform, an Inverse Fast Fourier Transform is performed.

18. (Previously Presented) The system according to claim 16, characterized in that a cyclic extension having a predetermined length is added to each sequence prior the transmission, the cyclic extension being greater than a delay spread.

19. (Currently Amended) The system according to claim 16, characterized in that the distance between each said predetermined step is greater than a delay spread.

20. (Previously Presented) The system according to claim 16, characterized in that at the receiving unit the received sequence

is Discrete Fourier Transformed and divided by the training sequence P(k); and, the result is Inverse Discrete Fourier Transformed resulting in a sequence having distinctly separated regions in the time domain, the separated regions containing the respective channel impulse response estimates.

21. (Previously Presented) The system according to claim 17, characterized in that at the receiving unit the received sequence is Fast Fourier Transformed and divided by the training sequence P(k); and, the result is Inverse Fast Fourier Transformed resulting in a sequence having distinctly separated regions in the time domain, the separated regions containing the respective channel impulse response estimates.

22. (Previously Presented) The system according to claim 20, characterized in that

fixed predetermined ranges are selected in the discrete time domain;
each range comprising one and only one of the above defined regions; and
one channel impulse response is selected from each of said ranges.

23. (Cancelled)

24. (Currently Amended) An arrangement in a wireless communication system comprising at least one transmitter provided with at least two antennas and at least one receiving unit provided with at least two antennas and wherein

training sequences are transmitted from the at least two antennas of the at least one transmitter to the at least two antennas of the at least one receiver unit, characterized by

means for performing, prior to the transmission, an Inverse Discrete Fourier Transformation on a training sequence P(k) to produce a sequence p(n);

means for performing, for each antenna branch, a cyclic rotation by a predetermined ~~number of steps~~ step of the Inverse Discrete Fourier Transformed sequence, said ~~steps~~ predetermined step being different for each antenna branch to generate cyclically rotated training sequences p(n-n1), p(n-n2);

means for transmitting concurrently the cyclically rotated training sequences p(n-n1), p(n-n2) from said at least two antennas to the receiving unit; and

means for using, at the receiving unit receiving the cyclically rotated training sequences, the received sequences, being a superposition of cyclically rotated transmitted training sequences each individually affected by the propagation medium, to provide channel impulse response estimates for the transmission from respective antenna.

25. (Currently Amended) The arrangement according to claim [[23]] 24, characterized in that instead of [[a]] an Inverse Discrete Fourier Transform, an Inverse Fast Fourier Transform is performed.

26. (Currently Amended) The arrangement according to claim 24, ~~characterized by~~ further comprising means for adding a cyclic extension having a predetermined length to each sequence prior to the transmission, the cyclic extension being greater than a delay spread.

27. (Currently Amended) The arrangement according to claim 24, characterized in that the distance between each said predetermined step is greater than a delay spread.

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28. (Previously Presented) The arrangement according to claim 24, characterized in that the receiving unit comprises means for:

performing a Discrete Fourier Transform and a division of the received sequence by the training sequence P(k); and

performing an Inverse Discrete Fourier Transform of the result, resulting in a sequence having distinctly separated regions in the time domain, the separated regions containing the respective channel impulse response estimates.

29. (Previously Presented) The arrangement according to claim 25, characterized in that the receiving unit comprises means for:

performing a Fast Fourier Transform and a division of the received sequence by the training sequence P(k); and,

performing an Inverse Fast Fourier Transform of the result, resulting in a sequence having distinctly separated regions in the time domain, the separated regions containing the respective channel impulse response estimates.

30. (Previously Presented) The arrangement according to claim 28, characterized in that the receiving unit comprises

means for selecting fixed predetermined ranges in the discrete time domain, each range comprising one and only one of the above defined regions; and

means for selecting one channel impulse response from each of said ranges.

31. (Cancelled)

32. (Currently Amended) A wireless communication system, comprising:
at least one transmitter provided with at least two antennas; and,
at least one receiving unit provided with at least two antennas; ~~and~~

wherein training sequences are transmitted from the at least two antennas of the at least one transmitter to the at least two antennas of the at least one ~~receiver~~ receiving unit~~, characterized in that~~; wherein:

first, prior to the transmission, a training sequence P(k) is Inverse Fast Fourier Transformed to a sequence p(n);

second, for each antenna branch the Inverse Fast Fourier Transformed sequence p(n) is cyclically rotated by a ~~number of~~ predetermined ~~steps~~ step (n1,n2), said predetermined step being different for each antenna branch to generate cyclically rotated training sequences p(n-n1), p(n-n2);

third, the cyclically rotated training sequences p(n-n1), p(n-n2) are transmitted concurrently from said at least two antennas to the receiving unit; and

fourth, at the receiving unit receiving the cyclically rotated training sequences, the received sequences p(n-n1), p(n-n2) being a superposition of cyclically rotated transmitted training sequences each individually affected by the propagation medium, are used to provide channel impulse response estimates for the transmission from respective antenna.

33. (Currently Amended) An arrangement in a wireless communication system comprising at least one transmitter provided with at least two antennas and at least one receiving unit provided with at least two antennas and wherein

training sequences are transmitted from the at least two antennas of the at least one transmitter to the at least two antennas of the at least one ~~receiver~~ receiving unit, characterized by

means for performing, prior to the transmission, an Inverse Fast Fourier Transformation on a training sequence P(k) to produce a sequence p(n);

means for performing, for each antenna branch, a cyclic rotation by a predetermined ~~number of steps~~ step of the Inverse Fast Fourier Transformed sequence, said ~~steps~~ predetermined step being different for each antenna branch to generate cyclically rotated training sequences p(n-n1), p(n-n2);

means for transmitting concurrently the cyclically rotated training sequences p(n-n1), p(n-n2) from said at least two antennas to the receiving unit; and

means for using, at the receiving unit receiving the cyclically rotated training sequences, the received sequences, being a superposition of cyclically rotated

transmitted training sequences each individually affected by the propagation medium, to provide channel impulse response estimates for the transmission from respective antenna.

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